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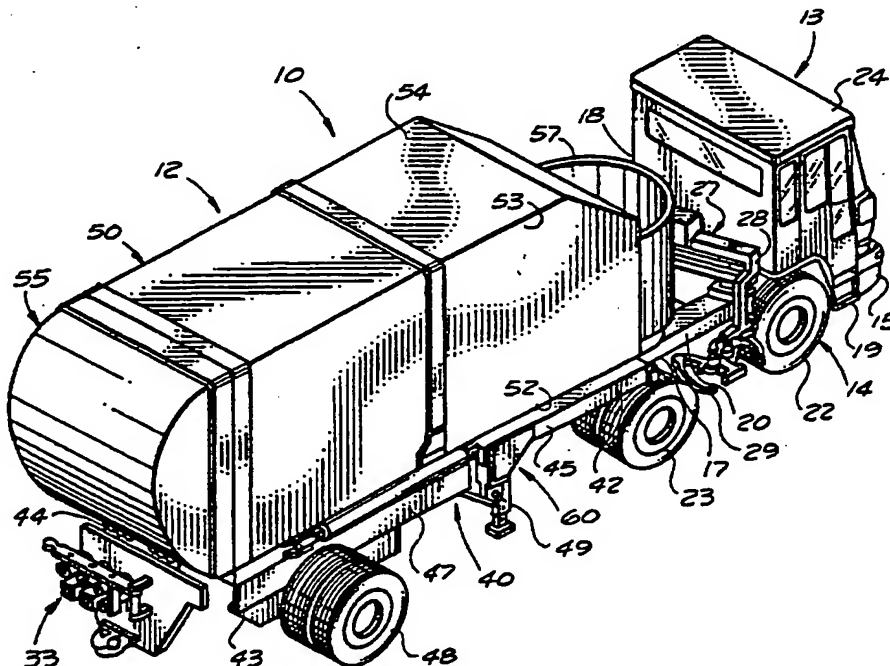
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(54) Title: AN ARTICULATED REFUSE COLLECTION APPARATUS



(57) Abstract

A refuse collection vehicle (10, 190) including a collection towing vehicle (13) having a refuse loading mechanism (27) for loading a semi-trailer (12, 192, 200) coupled to a fifth wheel (25, 124, 140), the semi-trailer having a refuse collection body (50, 211, 212) for receiving refuse from the refuse loading mechanism and a hoist mechanism (60) for tilting the refuse collection body.

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AN ARTICULATED REFUSE COLLECTION APPARATUS

This application claims priority to U.S. Patent Application Serial No. 08/033,127, filed 18 March 1993.

Technical Field

This invention relates to a refuse collection apparatus, and more particularly to an articulated refuse collection vehicle. In a further and more specific aspect, the present invention concerns the use of a roll-off semi-trailer including a removable refuse collection body removably carried thereby.

Background Art

The collection and removal of refuse, the solid waste of a community, is a major municipal problem. For example, residential refuse is generated at an average rate of approximately two pounds per day per capita. Other wastes, from commercial or industrial generators, typically add another pound. As accumulated, loose and uncompacted, the refuse has a density generally in the range of 150 to 300 pounds per cubic yard. For the health and welfare of the community, regular disposal is imperative.

Traditionally, residential refuse, including garbage, trash, and other waste materials were amassed and stored in containers of approximately 10 to 30 gallon capacity. On a regular basis, usually once or twice weekly, the containers were placed by the householder at a designated location for handling by the scheduled collection agency. Frequently designated locations were curb side and alley line. Not uncommonly, the refuse of a single residence, depending upon the number of occupants and the frequency of service, would occupy two or more containers, each weighing as much as 75 to 100 pounds. Commercial or industrial generators accumulated waste in larger, heavier containers.

1 Conventionally, these refuse containers were emptied
2 into a refuse collection vehicle which transported the
3 refuse to a disposal site. Disposal sites could be
4 landfills, dumps, incinerators, et. cetera. The
5 conventional refuse collection method involved a
6 mechanized unit supplemented with manual labor. The
7 mechanized unit, or collection vehicle, included a refuse
8 handling body mounted upon a truck chassis. Generally,
9 the vehicle was attended by a crew of three or more. One
10 of the crew, the driver, attended to operation of the
11 vehicle while the others, known as collectors, brought
12 the refuse to the vehicle.

13 Commonly, the vehicle included a hopper of
14 conveniently low loading height into which the collectors
15 emptied the containers. Means were provided for
16 transferring and compacting the refuse from the hopper
17 into the body. The body also included unloading means
18 for ejecting the refuse at the disposal site.

19 Recently, considerable effort has been devoted to
20 developing devices which increase the speed and
21 efficiency with which refuse is collected. The current
22 efforts are primarily directed towards automation of the
23 collection process. These devices generally employ a
24 self-loading device which engages, lifts, and dumps
25 refuse containers into the refuse handling body. A wide
26 variety of self-loading devices have been developed and
27 are in current use. These include side mounted arms and
28 front loading arms. The use of these devices greatly
29 increases the rate of collection.

30 While these self-loading devices greatly increase
31 the rate at which refuse is collected, they fail to
32 address pressing problems generated by increasing
33 population, health concerns, and the increase in refuse
34 volumes. Generally, these problems revolve around the
35 transportation of the collected refuse. At this time,
36 refuse can be collected faster and easier than at any
37 other time in history, however, disposal of this
38 collected waste is an ever growing problem.

1 Typically, refuse is transported to a landfill for
2 disposal. It is common for landfills to be located a
3 significant distance from the collection area. This is
4 especially true for large communities. The distance
5 refuse must be transported is growing quickly as
6 relatively nearby landfills are filled, and as
7 regulations limit the number of available sites requiring
8 the use of more distant landfills.

9 A major problem with transporting refuse to a
10 distantly located landfill is the increased cost
11 generated by the need to employ a highly specialized
12 vehicle, developed for refuse collection, to haul refuse
13 a great distance. A refuse collection vehicle is very
14 specialized, requiring heavy and expensive equipment. As
15 the amount and weight of equipment used increases, to
16 increase the speed and efficiency with which refuse is
17 collected, the amount of refuse an individual truck can
18 carry is reduced. This means the cost of collecting each
19 pound of refuse is increased due to a reduced payload,
20 increased cost of the vehicle, and time spent
21 transporting refuse instead of collecting it.

22 Innovators are attempting to deal with the necessity
23 of transporting refuse a great distance, and several
24 options have been developed. Trucks having a large
25 carrying capacity are being produced. This approach,
26 however, leads to an expensive truck which is relatively
27 difficult to maneuver, reducing collection efficiency. A
28 large refuse collection vehicle will lose time
29 maneuvering and remaneuvering in order to reach a refuse
30 container in a tight spot. This somewhat reduces the
31 efficiency attained by the automated loading mechanism.

32 While the larger vehicles are capable of carrying a
33 big load, all of the expensive, specialized equipment is
34 inactive much of the time, and is actually a hindrance
35 during transportation. The engine on the vehicle must
36 also be correspondingly larger to transport the heavy
37 loads to a distant disposal site, adding to weight and
38 expense of the vehicle. Simply increasing the size of

1 the refuse carrying body carried by the truck chassis
2 does not prevent the automatic loading mechanism from
3 being idle while in transport. This is inefficient,
4 wasting valuable collection time of expensive equipment.

5 In an attempt to eliminate the use of collection
6 equipment for transportation of refuse to a disposal
7 site, the use of transfer stations has been developed.
8 Transfer stations are generally large shed-like
9 structures located centrally of a collection area.
10 Refuse collection vehicles collect a load, and travel a
11 short distance to this central location where they
12 deposit the refuse. The deposited refuse is then loaded
13 into transportation vehicles generally consisting of
14 large open-topped tractor trailer rigs. Large expensive
15 machinery transfers the deposited refuse into the
16 transportation vehicles. These vehicles lacking the
17 heavy self-loading mechanisms and built for long hauls,
18 efficiently transport large volumes of material to
19 distant disposal sites. Transfer stations allow refuse
20 collection vehicles to make additional collection trips
21 since very little time has been used transporting the
22 refuse to the transfer station.

23 While this development releases collection equipment
24 from the need to transport refuse a great distance, it
25 does require a very expensive structure in a central
26 location. Transfer stations require a large area in a
27 conveniently located area easily accessible by large
28 transport vehicles and refuse collection vehicles.
29 Locations for transfer stations may be difficult to
30 obtain due to opposition by local property owners, city
31 ordinances or other factors. Furthermore, transfer
32 stations are large expensive structures requiring a large
33 expenditure for start-up.

34 It would be highly advantageous, therefore, to
35 remedy the foregoing and other deficiencies inherent in
36 the prior art.

1 Accordingly, it is an object of the present
2 invention to provide a new and improved refuse collection
3 vehicle.

4 Another object of the present invention is to
5 provide a refuse collection vehicle which will permit
6 efficient use of time and equipment.

7 And another object of the present invention is to
8 provide a refuse collection vehicle which is flexible and
9 will meet substantially any requirements of a community,
10 accommodating refuse from individual households, from
11 larger commercial generators or for even larger
12 commercial or industrial generators.

13 Still another object of the present invention is to
14 provide a refuse collection vehicle which is articulated
15 to maintain maneuverability while carrying a large
16 payload.

17 Yet another object of the present invention is to
18 provide a refuse collection vehicle which has a semi-
19 trailer refuse carrier which may be used to collect and
20 transport refuse.

21 Yet a further object of the present invention is to
22 provide an articulated refuse collection vehicle which
23 can grab and dump a refuse container that is essentially
24 at any angle relative the semi-trailer.

25 And yet a further object of the present invention is
26 to provide a refuse collection vehicle which does not
27 require an expensive transfer station while still
28 transporting refuse a great distance to a disposal site,
29 collecting and disposing of a large volume of refuse, and
30 employing a minimum of equipment.

31 A further object of the present invention is to
32 provide an articulated refuse vehicle which may include a
33 dolly to which an additional semi-trailer can coupled.

1 Disclosure of the Invention

2 Briefly, to achieve the desired objects of the
3 instant invention in accordance with a preferred
4 embodiment thereof, provided is a refuse collection
5 vehicle which includes a semi-trailer having a refuse
6 collection body with a tailgate assembly, a hopper, and a
7 compacter for moving refuse from the hopper to a storage
8 area. A coupling assembly pivotally couples the semi-
9 trailer to a collection tow vehicle having a fifth wheel
10 and a loader assembly, for collecting refuse.

11 In a another embodiment, the refuse collection
12 vehicle includes a semi-trailer having roll-off rails
13 mounted on a frame for receiving a refuse collection
14 body, a winch mechanism coupled to the frame and a hoist
15 mechanism coupled to the frame.

16 Furthermore, the articulated refuse collection
17 vehicle may include a dolly having a dolly frame carried
18 by a set of wheels, a fifth wheel carried by the frame
19 for couplingly receiving a second semi-trailer, and a tow
20 coupling assembly coupling the dolly to the first semi-
21 trailer.

1 Brief Description of the Drawings

2 The foregoing and further and more specific objects
3 and advantages of the instant invention will become
4 readily apparent to those skilled in the art from the
5 following detailed description of the preferred
6 embodiment thereof taken in conjunction with the drawings
7 in which:

8
9 Fig. 1 is a perspective view of an articulated
10 refuse collection vehicle consisting of a semi-trailer
11 coupled to a collection tow vehicle constructed in
12 accordance with the teachings of the instant invention;
13

14 Fig. 2 is a side view of the refuse collection
15 vehicle illustrated in Fig. 1 with the semi-trailer in
16 the dump position;
17

18 Fig. 3 is a partial perspective view of the hoist
19 mechanism of the semi-trailer as it would appear coupled
20 to the collection tow vehicle;
21

22 Fig. 4 is a top view illustrating the various
23 positions of the collection tow vehicle pivotally coupled
24 to the semi-trailer, showing the discharge of a refuse
25 container into the hopper of the semi-trailer;
26

27 Fig. 5 is a top view of a refuse collection vehicle
28 illustrating the operators visibility;
29

30 Fig. 6 is a partial side elevational view of a
31 refuse collection vehicle consisting of a semi-trailer
32 coupled to a collection tow vehicle, illustrating
33 positioning of the refuse loading mechanism above the
34 hopper;
35

36 Fig. 7 is a top view of an alternate embodiment of
37 the refuse collection vehicle illustrating a conventional
38 compacter mechanism in the hopper of the semi-trailer;

1 Fig. 8 is a side view illustrating a refuse
2 collection vehicle consisting of tandem semi-trailers
3 coupled together by a dolly and towed by a transport tow
4 vehicle;

5
6 Fig. 9 is a side view illustrating a large double
7 axle semi-trailer coupled to a collection tow vehicle;

8
9 Fig. 10 is a top view illustrating an alternate
10 embodiment of a refuse collection vehicle, showing a
11 roll-off semi-trailer coupled to a tow vehicle;

12
13 Fig. 11 is a side view illustrating the refuse
14 collection vehicle of Fig. 10 with a roll-off semi-
15 trailer hoisted to the tilt position for positioning a
16 roll-off container;

17
18 Fig. 12 illustrates a refuse collection vehicle
19 similar to that illustrated in Figs. 10 and 11 with a
20 roll-off semi-trailer hoisted to the tilt position for
21 positioning a removable refuse collection body;

22
23 Fig. 13 illustrates an alternate embodiment of a
24 refuse collection vehicle showing a semi-trailer coupled
25 to a collection tow vehicle having a pivotal loading arm
26 capable of replacing conventional front loading vehicles;
27 and

28
29 Fig. 14 is a side view of the refuse collection
30 vehicle illustrated in Fig. 13 showing the dumping action
31 of the pivotal loading arm.

1 Best Mode for Carrying Out the Invention

2 Turning now to the drawings in which like reference
3 characters indicate corresponding elements throughout the
4 several views, attention is first directed to Fig. 1
5 which illustrates an articulated refuse collection
6 vehicle generally designated by the reference character
7 10. Articulated refuse collection vehicle 10 consists of
8 a semi-trailer 12 and a collection towing vehicle 13.

9 Collection towing vehicle 13 includes a chassis 14,
10 which, for purposes of orientation in the ensuing
11 discussion, is considered to have a forward end 15 a
12 rearward end 17, a left or street side 18 and a right or
13 curb side 19. Chassis 14 includes a frame 20 supported
14 above ground level by front wheels 22 and rear wheels 23.
15 In accordance with conventional practice, front wheels 22
16 being steerable, provide directional control for the
17 vehicle. Similarly, rear wheels 23 are caused to rotate
18 in response to a conventional engine, transmission and
19 drive train, not specifically illustrated, for propulsion
20 of the unit. A cab 24, carried at forward end 15 of
21 chassis 14 provides for an enclosed driver's compartment
22 including the conventional controls associated with the
23 manipulation of the chassis as well as conventional
24 controls associated with the loading and compacting
25 equipment. A fifth wheel assembly 25, visible in Figs. 2
26 and 7, is carried at rearward end 17 of frame 20. Fifth
27 wheel 25 may be any conventional design well known to
28 those skilled in the art, used in association with a
29 semi-trailer.

30 A refuse loading mechanism generally designated 27
31 is carried by frame 20 intermediate cab 24 and fifth
32 wheel assembly 25. In this preferred embodiment, refuse
33 loading mechanism 27 consists of an extendable sidearm 28
34 terminating in a gripping member 29. Those skilled in
35 the art will understand that various different types and
36 designs of refuse loading mechanisms may be mounted on
37 frame 20 for collection of refuse. Additional
38 embodiments will be discussed below.

1 Various control media such as hydraulic, pneumatic,
2 and electrical are conventionally supplied to various
3 equipment by control conduits not specifically
4 illustrated but well known to those skilled in the art.

5 Still referring to Fig. 1 semi-trailer 12 includes a
6 trailer chassis 40, which, for purposed of orientation is
7 considered to have a forward end 42, a rearward end 43, a
8 left or street side 44, and a right or curb side 45.
9 Trailer chassis 40 includes a frame 47 supported above
10 ground level by rear wheels 48 proximate rearward end 43
11 and landing gear 49 carried intermediate forward end 42
12 and rearward end 43. A king pin (not specifically
13 viewable due to its location) extends downwardly from
14 trailer chassis 40 proximate forward end 42, and is
15 rotatably and releasable received by fifth wheel assembly
16 25 for coupling semi trailer 12 to towing vehicle 13.

17 A refuse collection body, generally designated by
18 the referenced character 50 is carried upon chassis 40.
19 Refuse collection body 50 is a hollow refuse receiving
20 and storage receptacle generally defined by a bottom or
21 lower horizontal panel 52, a pair of spaced apart upright
22 side panels 53 (only one herein specifically
23 illustrated), and a top or upper horizontal panel 54. At
24 rearward end 43, the receptacle is normally closed by a
25 tailgate assembly 55.

26 An arcuate hopper 57 is formed integral with the
27 forward portion of refuse collection body 50 proximate
28 forward end 42. Refuse, received by hopper 57 from
29 refuse loading mechanism 27, is moved from hopper 57 to
30 the storage receptacle by a rotating compacter mechanism
31 58, or swinging platen, coupled to a pivot point within
32 hopper 57 and rotating about a vertical axis, as can be
33 seen with further reference to Fig. 4.

34 Referring now to Fig. 4, an articulated refuse
35 vehicle 10 consisting of collection towing vehicle 13 and
36 a semi-trailer 12, is illustrated. As can be seen by the
37 broken lines, collection towing vehicle 13 may be pivoted
38 about fifth wheel assembly 25, which can be seen in Figs.

1 2 and 6, in relation to semi-trailer 12. The pivoting
2 movement, permitted by the coupling between the king pin
3 and fifth wheel assembly 25, allows for high
4 maneuverability in a relatively large vehicle.

5 Since refuse loading mechanism 27 mounted on
6 collection towing vehicle 13 discharges a refuse
7 container in a substantially fixed location relative
8 collection towing vehicle 13, the highly articulated
9 nature of articulated refuse vehicle 10 may present a
10 problem in discharging refuse into hopper 57. In other
11 words, when collection towing vehicle 13 is angled with
12 respect to semi-trailer 12, a refuse container engaged by
13 refuse loading mechanism 27 may not properly discharge
14 into hopper 57. To overcome this problem, loading
15 mechanism 27 is configured to empty refuse containers
16 directly over fifth wheel assembly 25. Furthermore,
17 hopper 57 is centered generally over the king pin. When
18 semi trailer 12 is coupled to collection towing vehicle
19 13, hopper 57 is positioned over fifth wheel assembly 25.
20 Preferably, the pivot point of compactor 58 is positioned
21 directly over the king pin. Refuse loading mechanism 27
22 is mounted, so that refuse is discharged over fifth wheel
23 assembly 25 and thus the king pin when semi trailer 12 is
24 coupled to collection towing vehicle 13. Gripper member
25 29 and refuse loading mechanism 27, of which it is a
26 part, are positioned so as to discharge refuse from
27 refuse containers onto the area of the king pin. Since
28 the distance between the king pin and refuse loading
29 mechanism 27 does not vary regardless of the orientation
30 of collection towing vehicle 13 with semi-trailer 12, and
31 hopper 57 is positioned with the pivot point of compactor
32 58 over the king pin, refuse loading mechanism 27 will
33 always discharge refuse from the refuse containers
34 directly into hopper 57.

35 While a variety of hoppers with associated compactor
36 mechanisms may be used, arcuate hopper 57 with a swinging
37 platen 58 is preferred. Arcuate hopper 57 is preferred
38 for reasons of increased visibility for the

1 operator/driver, as can be seen with additional reference
2 to Fig. 5. The operator/driver seated on the left or
3 street side of cab 24 must be able to visually follow the
4 operation of gripping member 29 of refuse loading
5 mechanism 27 and the area about the refuse container to
6 be gripped. The rounded off sides of arcuate hopper 57
7 permit a wider field of view for the operator/driver when
8 a side mounted refuse loading mechanism, extending from
9 the side opposite the operator/driver, is used. Using
10 arcuate hopper 57 permits increased visibility when the
11 highly articulated semi-trailer is in any of the numerous
12 positions of which it is capable, as shown in Fig. 4.

13 Arcuate hopper 57 using swinging platen 58, also
14 allows continuous deposit of refuse into the hopper,
15 without requiring the operator to wait for the compactor
16 to complete its cycle before depositing refuse. This
17 permits large volumes of refuse to be deposited into
18 hopper 57 at one time.

19 Fig. 6 illustrates the retraction of sidearm 28 to
20 position gripper 29 of refuse loading mechanism 27 above
21 hopper 57. As can be seen gripper 29 is directly above
22 fifth wheel assembly 25 and thus hopper 57.

23 Fig. 7 illustrates the use of a square hopper 59
24 with a reciprocating compacter 61, replacing arcuate
25 hopper 57 with rotating compacter 58. Either one may be
26 used since the refuse loading mechanism 27 is aligned to
27 discharge refuse directly over the king pin which is
28 positioned generally under the center region of the
29 hopper.

30 Semi-trailer 12 may also include a refuse ejecting
31 apparatus for emptying refuse from semi-trailer 12. The
32 refuse ejecting apparatus may be conventional apparatus,
33 or a unique hoist mechanism 60 functioning as part of
34 chassis 40. Hoist mechanism 60 includes an end pivotally
35 coupled to frame 47, and an opposing end terminating in a
36 coupling assembly 62. In this embodiment, coupling
37 assembly 62 including a king pin (not visible), which is
38 received by fifth wheel assembly 25 of collection tow

1 vehicle 13. Hoist mechanism 60 will be discussed in
2 greater detail below.

3 Referring now to Figs. 2 and 3, trailer frame 47
4 consists of parallel spaced apart longitudinal channel
5 beams 67, having a top surface 68, an outer side surface
6 69, and a bottom surface 70, and landing gear 49. Frame
7 47 is coupled to collection tow vehicle 13 by hoist
8 mechanism 60. Landing gear 49 each include a generally
9 square tube 72, extending vertically downward from bottom
10 surface 70 of channel beams 67. Adjustable legs 73 are
11 received by square tubes 72 and are adjustably held in
12 place by pins 74 extending through bores 75 formed in
13 square tube 72 and corresponding bores in 77 in legs 73.
14 The series of vertical tube bores 75 in square tube 72
15 allow legs 73 to be adjusted upward or downward as
16 desired. This adjustability allows for use on varied
17 fifth wheel heights and differing ground conditions. A
18 strut 78 extends from square tube 72 rearward and upward,
19 attaching to bottom surface 70 of channel beams 67.

20 Hoist mechanism 60 consists of parallel spaced apart
21 generally L-shaped members 80 having horizontal main
22 portions 82 with a terminal end 83 and a boss end 84. A
23 vertical leg portion 85 depends downward from boss end 84
24 of generally L-shaped members 80 terminating in a
25 terminal end 87. Terminal ends 83 of main portion 82 are
26 pivotally coupled to opposing sides of a top surface 88
27 of a plate 89. A clevis connection pivotally couples
28 terminal ends 83 to top surface 88 of plate 89. The
29 clevis connections each consist of a bifurcated bracket
30 90 having inner and outer furcations spaced to receive
31 terminal end 83 of main portion 82 therebetween. A bore
32 92 is formed through the furcations of bifurcated bracket
33 90 and a bore 93 is formed through terminal end 83 of
34 main portion 82. A pin 94 is received by bores 92 and 93
35 thereby pivotally connecting main portion 92 to plate 89.
36 A king pin (not shown) extends downward from plate 89,
37 forming coupling assembly 62, for rotational engagement
38 with fifth wheel assembly 25.

1 L-shaped members 80 are pivotally coupled to trailer
2 frame 47 so as to be positioned to the outside of channel
3 beams 67, parallel therewith in a lowered position. An
4 attachment member 100 extends downward from terminal end
5 87 of vertical leg 85, and has a bore 102 formed
6 therethrough. A socket 103 having a bore 104 is formed
7 at the junction of strut 78 and square tube 72; and is
8 configured to align with bore 102 of attachment member
9 100 to receive a pin 105. Pin 105 is journaled in bores
10 102 and 104 allowing pivotal movement between trailer
11 frame 47 and L-shaped members 80.

12 Semi-trailer 12 is hoisted by pivoting trailer frame
13 47 and L-shaped members 80 at socket 103. The pivoting
14 movement is achieved by a motor means, which in this
15 embodiment is a hoist cylinder assembly 107 residing on
16 outer side surfaces 69 of channel beams 67. Hoist
17 cylinder assembly 107 includes a cylinder 108 and
18 reciprocally moveable operating rod 109 which is
19 extendable in response to the introduction of pressurized
20 fluid into cylinder 108 in accordance with conventional
21 practice. Cylinder 108 terminates at one end with an
22 attachment member 110 pivotally secured to a bifurcated
23 bracket 112 by a bolt and nut assembly 113. Bifurcated
24 bracket 112 is affixed to outer side surface 69 of
25 channel beams 67. Bifurcated bracket 112, in this
26 embodiment, is attached to a flange extending from outer
27 side surface 69 of channel beam 67. Although only one
28 hoist cylinder assembly 107 is specifically seen in the
29 drawings, it will be appreciated that a hoist cylinder
30 assembly 107 resides on outer side surfaces 69 of each
31 channel beam 67. Operating rod 109 terminates at the
32 free end with eye 114. A boss 118 extends from boss end
33 84 of main portion 82 terminating in a bifurcated bracket
34 117 configured to receive eye 114 between furcations
35 thereof. A nut and bolt assembly 115 extends through
36 bifurcated bracket 117 and eye 114 pivotally securing
37 reciprocating operating rod 109 to L-shaped members 80.

1 For added stability and support, cross pieces 119 extend
2 between L-shaped members 80.

3 With cylinder assembly 107 in the retracted
4 position, L-shaped members 80 reside in a substantially
5 horizontal orientation. In response to the introduction
6 of pressurized fluid into cylinder 108, operating rod 109
7 is extended in the direction indicated by arrowed line A
8 urging L-shaped member 80 to pivot upward about the axis
9 provided by pins 94 as indicated by the arrowed line B.
10 As reciprocating operating rod 109 continues to be
11 extended, trailer frame 47 pivots about the axis provided
12 by pin 105 as indicated by the arrowed line C, resulting
13 in the forward end of frame 47 pivoting upward about rear
14 wheels 48. Hoist cylinder assembly 107 pivots about the
15 axis provided by nut and bolt assembly 113 in the
16 direction indicated by the arrowed line D as seen in Fig.
17 2. As operating rod 109 is extended, trailer frame 47
18 pivots upward about the axis provided by rear wheels 48
19 as indicated by the arrowed line E.

20 When in the hoisted position, the refuse carried in
21 refuse collection body 50 of semi-trailer 12 may be
22 dumped out an opened tailgate assembly 55. The angle of
23 bottom 52 is sufficient, when hoisted, to allow refuse to
24 slide out without requiring any additional mechanism for
25 ejecting it through the tailgate assembly.

26 In an alternate configuration, semi-trailer 12 may
27 be coupled to a dolly 120 as illustrated in Fig. 8.
28 Dolly 120 allows a towing vehicle to tow more than one
29 semi-trailer 12, in a tandem configuration. The tandem
30 configuration is illustrated in Fig. 8, which shows an
31 alternate embodiment 121 of articulated refuse vehicle
32 10. Dolly 120 is coupled to the rearward end of trailer
33 frame 47. Dolly 120 consists of a dolly frame 122
34 carried by a set of wheels 123. A fifth wheel assembly
35 124 is carried by frame 122 for rotational coupling with
36 coupling assembly 62. Various control media such as
37 hydraulic, pneumatic, and electrical are conventionally
38 supplied to various equipment by control conduits not

1 specifically illustrated but well known to those skilled
2 in the art. These control media are supplied to dolly
3 120 for control of a coupled semi-trailer 12 by control
4 conduits coupled between semi-trailers in any manner
5 known to those skilled in the art. Dolly 120 may be
6 coupled to a semi-trailer 12 or a towing vehicle, by a
7 tow coupling assembly, which in this embodiment is
8 preferably a pintle hitch consisting of a female element
9 127 extending from dolly frame 122 of dolly 120, and a
10 male element 128 extending from frame 47 of semi-trailer
11 12.

12 Still referring to Fig. 8, it can be seen that a tow
13 vehicle lacking a refuse loading mechanism 27, is towing
14 semi-trailer 12 to which dolly 120 is coupled. The
15 vehicle illustrated is a transport towing vehicle
16 generally designated 130, which would be used to replace
17 collection towing vehicle 13 for transport purposes. The
18 use of transport towing vehicle 130 to transport semi-
19 trailer 12 to a disposal site, frees collection towing
20 vehicle 13 to use its specialized equipment, specifically
21 refuse loading mechanism 27, to collect more refuse.
22 Transport towing vehicle 130 consists of a chassis 132,
23 which, for purposes of orientation throughout the ensuing
24 discussion, is considered to have a forward end 133 and a
25 rearward end 134. Chassis 132 includes a frame 135
26 supported above ground level by front wheels 137 and rear
27 wheels 138. In accordance with conventional practice,
28 front wheels 137, being steerable, provide directional
29 control for the vehicle. Similarly, rear wheels 138, are
30 caused to rotate in response to a conventional engine,
31 transmission and drivetrain, not specifically
32 illustrated, for propulsion of the unit. A cab 139,
33 carried at the forward end 133 of frame 135, provides for
34 an enclosed driver's compartment including the
35 conventional controls associated with manipulation of
36 chassis 132 in addition to the controls for operating the
37 semi-trailers. A fifth wheel assembly 140, generally of
38 a conventional configuration, is carried by frame 135

1 towards rearward end 134. Fifth wheel assembly 140
2 rotatably receives coupling assembly 62 of semi-trailer
3 12.

4 Embodiment 121 of an articulated refuse vehicle,
5 consists of transport towing vehicle 130 towing a first
6 semi-trailer 12a, and a second semi-trailer 12b. Second
7 trailer 12b is coupled to trailer 12a by a dolly 120. In
8 this illustration, second semi-trailer 12b is illustrated
9 with hoist mechanism 60 activated, tilting refuse
10 collection body 50 into a dump position. Tailgate
11 assembly 55 has been raised allowing refuse to be dumped.
12 This illustration shows that semi-trailers 12 may be
13 controlled and activated while attached to dollies 120
14 and illustrates that trailers may be discharged from
15 either dollies 120 or vehicles such as 130 or 13.

16 Transport towing vehicle 130 may be substantially
17 identical to collection towing vehicle 13, without refuse
18 loading mechanism 27. Preferably, a transport towing
19 vehicle 130 has a larger engine to facilitate hauling of
20 large amounts of refuse over long distances. Collection
21 towing vehicle 13 typically, has a smaller engine,
22 reducing the cost of the vehicle, since only relatively
23 short distances must be traversed, requiring less power.
24 The numerous components described, provide a very
25 flexible refuse collection vehicle.

26 Fig. 9 illustrates a further embodiment generally
27 designated 190 of an articulated refuse vehicle
28 consisting of a single, double axle trailer 192. Semi-
29 trailer 192 is substantially identical to semi-trailers
30 12, with increased dimensions, and a double axle 193 to
31 support heavier loads. Semi-trailer 192 is hauled by a
32 collection towing vehicle 13 as described above. Semi-
33 trailer 192 may be dimensioned to carry a volume of
34 approximately 50 cubic yards. It may have a payload of
35 approximately 15 tons. For many haulers, 15 tons is a
36 days work for collecting and hauling. Since the wheel
37 base from rear wheels 23 of collection towing vehicle 13
38 to the double axle 193 of semi-trailer 192 is about the

1 same as for a conventional 30 cubic yard body mounted on
2 a conventional truck chassis, the combination is at least
3 as maneuverable, due to the articulation, with one and
4 one half times the payload capacity.

5 Turning now to Figs. 10, 11 and 12, an alternate
6 embodiment of a semi-trailer generally designated 200 is
7 illustrated. Semi-trailer 200 consists of a trailer
8 chassis 202 having a forward end 203 and a rearward end
9 204. Chassis 202 includes a frame 205 supported by rear
10 wheels 207 located at rearward end 204, landing gear 208
11 located approximate forward end 203 and a hoist mechanism
12 209, substantially identical to hoist mechanism 60
13 described above. Hoist mechanism 209 couples frame 205
14 to fifth wheel assembly 140 of transport towing vehicle
15 130. Those skilled in the art will understand that
16 other, conventional hoist mechanisms may be employed,
17 replacing hoist mechanism 209. A rail assembly 210 is
18 carried by frame 205, to receive a refuse collection
19 body. In Fig. 10 and 11, a refuse collection body 212
20 consists of a large, generally rectangular roll off
21 refuse container having sidewalls 213, endwalls 214 and a
22 bottom 215. Wheels 217 are carried by bottom 215 and are
23 receivable on rail assembly 210. Referring to Fig. 12, a
24 removable refuse collection body 211 consists of a refuse
25 collection body 50 and a hopper 57, as described
26 previously in connection with Fig. 1, mounted upon a
27 frame 216. A winch assembly 218, not visible, coupled to
28 chassis 202, aids in loading removable refuse collection
29 body 211 and 212.

30 To load removable refuse collection body 211 or 212
31 onto semi-trailer 200, hoist mechanism 209 is activated,
32 tilting frame 205 upward. A cable 219 is coupled from
33 winch assembly 218 to removable refuse collection body
34 211 or 212. Wheels 217 of removable collection body 212
35 and frame 216 of removable collection body 211, are
36 received by rail assembly 210 and pulled gradually upward
37 along rail assembly 210 by winch assembly 218. Once
38 removable refuse collection body 211 or 212 is fully

1 winched onto rail assembly 210, hoist mechanism 209 is
2 lowered. A filled removable refuse collection body 211
3 or 212 may now be transported to a disposal site, or
4 delivered empty to a new location. Figs. 10 and 11
5 illustrate semi-trailer 200 coupled to a fifth wheel
6 assembly 140 of tow vehicle 130 not equipped with a
7 refuse loading mechanism, while Fig. 12 shows semi-
8 trailer 200 coupled to collection tow vehicle 13 having a
9 refuse loading mechanism which operates in a manner
10 described above.

11 Semi-trailer 200 may be used in combination with
12 semi-trailers 12, and carried by dollies 120. It may be
13 emptied by tilting hoist mechanism 209 attached to either
14 dolly 120 or a vehicle such as 130. This allows the
15 refuse collection vehicle to be tailored to a community
16 which requires large containers for dumping bulk refuse
17 or a community which desires one vehicle capable of
18 carrying a variety of items for different uses, such as
19 removable refuse collection body 211.

20 Referring now to Figs. 13 and 14, an alternate
21 embodiment of a collection towing vehicle generally
22 designated 260 is illustrated. Collection vehicle 260 is
23 substantially similar to collection towing vehicle 13,
24 including a chassis 14 a frame 20 and a fifth wheel
25 assembly 25. While generally analogous, the immediate
26 embodiment 260 differs by virtue of a pivotal loader arm
27 262 mounted adjacent a cab 263 in a space 264 defined by
28 cab 263 and curb side 19 of frame 20. Pivoting loader
29 arm 262 consists of an arm 267, which is telescopingly
30 extendable, having a pivot end 268, pivotally attached
31 to a clevis fitting 269 for pivotal movement in a
32 vertical direction. Clevis fitting 269 consists of a
33 bifurcated bracket 270 pivotally mounted to frame 20 in
34 space 264. Bifurcated bracket 270 rotates horizontally,
35 swinging pivoting loader arm 262 in an arch, illustrated
36 by arrowed line F. Horizontal rotation is achieved by
37 motor means, which may be any conventional rotary or
38 reciprocating drive mechanism, positioned beneath space

1 264 and not visible. A pin 272 extends through
2 bifurcated bracket 270 and pivot end 268 of arm 267. A
3 pivot cylinder 273 coupled between clevis fitting 269
4 proximate frame 20 and a terminal end 274 of arm 267,
5 pivots arm 267 about the axis provided by pin 272 as
6 indicated by the arrowed line G. A lifting attachment
7 275 is coupled to terminal end 274 of arm 267.

8 As can be seen in Figs. 13 and 14, lifting
9 attachment 275 of pivoting loader arm 262 may engage a
10 refuse container in a forward direction or at
11 intermediate locations around to the side as illustrated
12 by broken line 276. To empty the refuse container into
13 hopper 57, pivoting loader arm 262 must be rotated until
14 it is directed in a substantially forward direction, to
15 ensure deposit of refuse into hopper 57. Pivoting loader
16 arms such as 262 are familiar to those skilled in the
17 art.

18 Various changes and modifications to the embodiment
19 herein chosen for purposes of illustration will readily
20 occur to those skilled in the art. To the extent that
21 such modifications and variations do not depart from the
22 spirit of the invention, they are intended to be included
23 within the scope thereof which is assessed only by a fair
24 interpretation of the following claims.

1 Industrial Applicability

2 The present invention is capable of being exploited
3 in any situation where refuse is required to be collected
4 and transported to a distant site. The present invention
5 is particularly appropriate for large rural areas
6 generating large volumes of refuse, and areas requiring
7 diverse refuse collection techniques.

CLAIMS

1. An articulated refuse collection vehicle for collecting and transporting refuse comprising:

- a) a collection towing vehicle including;
 - i) a chassis having a rearward end and a forward end;
 - ii) a fifth wheel carried by said chassis proximate said rearward end;
 - iii) a cab carried by said chassis proximate said forward end;
 - iv) a refuse loading mechanism carried by said chassis intermediate said cab and said fifth wheel for emptying refuse containers above said fifth wheel; and
- b) a semi trailer rotatably and removably coupled to said fifth wheel of said towing vehicle.

2. An articulated refuse collection vehicle as claimed in claim 1 wherein said semi-trailer includes:

- a) a chassis having a forward end, a rearward end, and a frame carried by rear wheels proximate said rearward end; and
- b) a king pin coupled to and extending downward from said chassis proximate said forward end, said king pin rotatably and removably received by said fifth wheel; and
- c) a refuse collection body carried by said chassis.

3. An articulated refuse collection vehicle as claimed in claim 2 wherein said refuse collection body includes:

- a) a storage receptacle having a forward end and a rearward end;

- b) a hopper coupled to said forward end of said storage receptacle, said hopper being positioned directly above said king pin for receiving refuse;
- c) a compacter carried by said hopper; and
- d) a tailgate assembly coupled to said rearward end of said storage receptacle.

4. An articulated refuse collection vehicle as claimed in claim 2 wherein said semi-trailer further includes:

- a) roll-off rails mounted on said frame for receiving said refuse collection body;
- b) a winch mechanism coupled to said frame;
- and
- c) a hoist mechanism coupled to said frame.

5. An articulated refuse collection vehicle as claimed in claim 4 wherein said refuse collection body includes:

- a) a storage receptacle having a forward end and a rearward end;
- b) a hopper coupled to said forward end of said storage receptacle, said hopper being positioned directly above said king pin for receiving refuse;
- c) a compacter carried by said hopper; and
- d) a tailgate assembly coupled to said rearward end of said storage receptacle.

6. An articulated refuse collection vehicle as claimed in claim 5 wherein said hoist mechanism includes:

- a) a first and a second generally L-shaped member each having a main portion and a leg portion, said main portion and said leg portion each include a terminal end and an opposite end, with the opposite

ends being attached so as to form an angle therebetween;

- b) said terminal ends of each said main portions being pivotally attachable to said collection tow vehicle;
- c) said terminal ends of each said leg portion being pivotally attached to said frame of said semi-trailer; and
- d) motor means coupled between said frame and said angle for pivoting said generally L-shaped member about said terminal ends so as to move said semi-trailer frame between a retracted position and a tilt position.

7. An articulated refuse collection vehicle as claimed in claim 6 wherein said terminal ends of said main portions of said first and said second generally L-shaped members, are pivotally coupled to said collection tow vehicle by means of a coupling assembly.

8. An articulated refuse collection vehicle as claimed in claim 7 wherein said coupling assembly includes:

- a) a plate having an top surface and a bottom surface; and
- b) said king pin extending downward from said bottom surface of said plate.

9. An articulated refuse collection vehicle as claimed in claim 8 wherein said hopper is carried by said frame, centered over said king pin in said retracted position.

10. An articulated refuse collection vehicle as claimed in claim 1 further comprising a dolly having a dolly frame carried by a set of wheels, a fifth wheel

FIG. 1

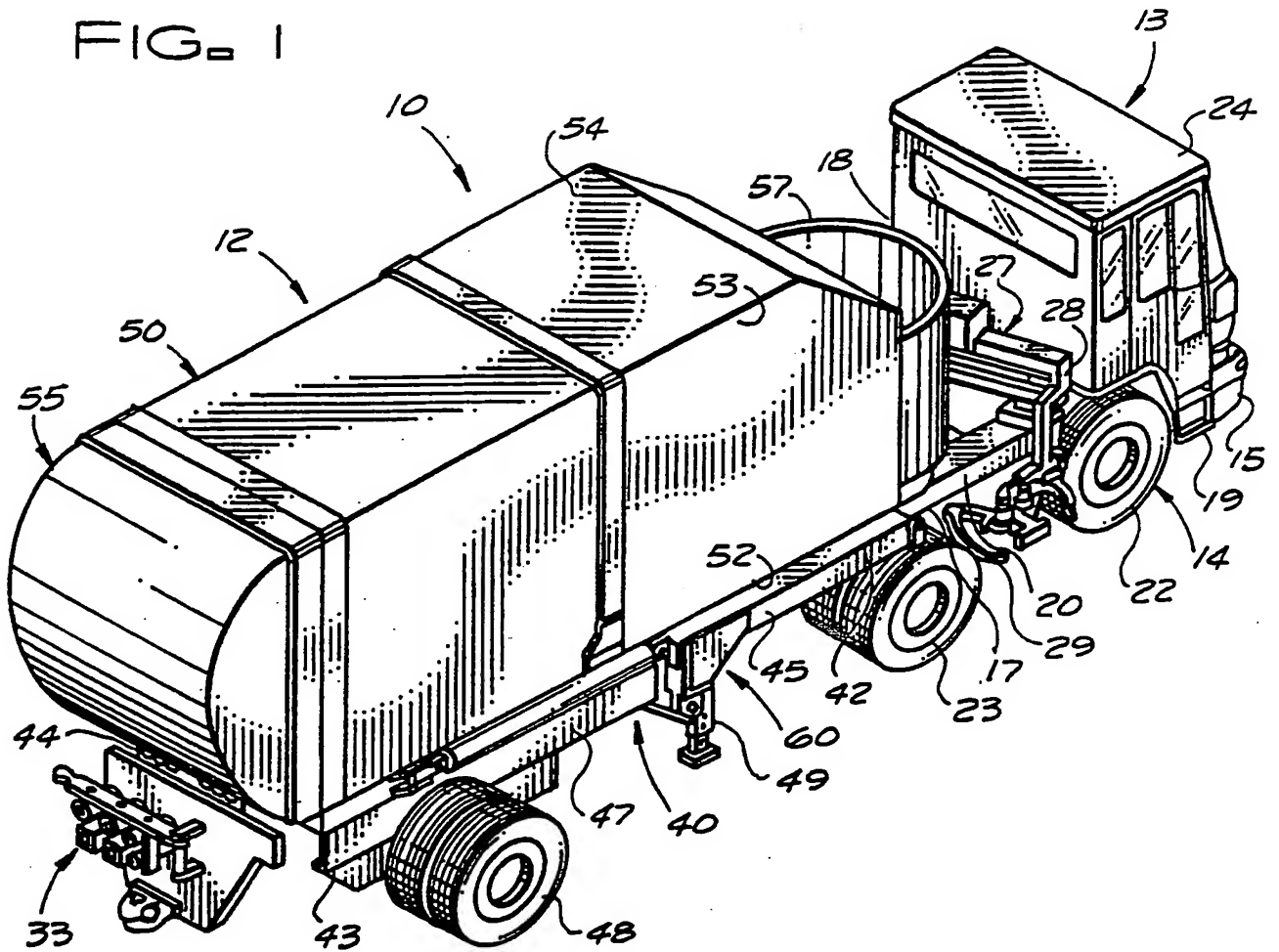
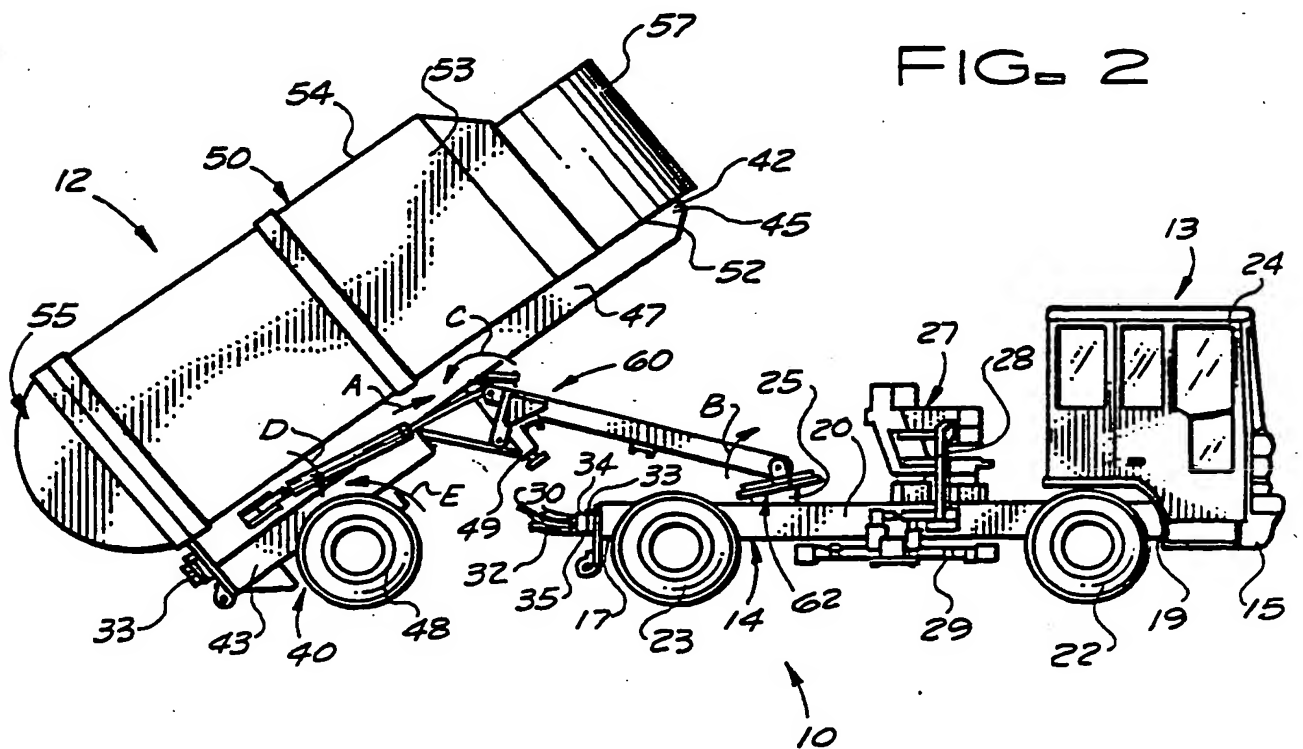


FIG. 2



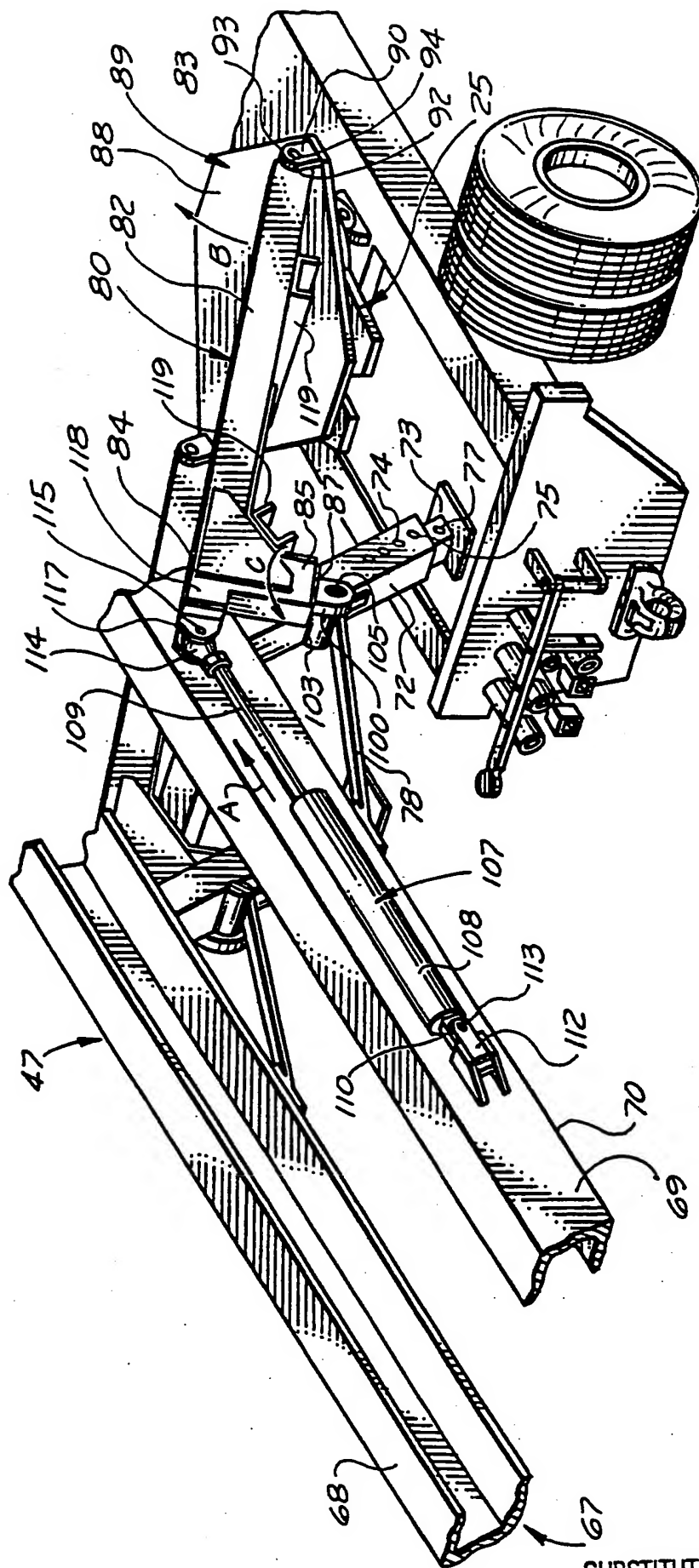


FIG. 3

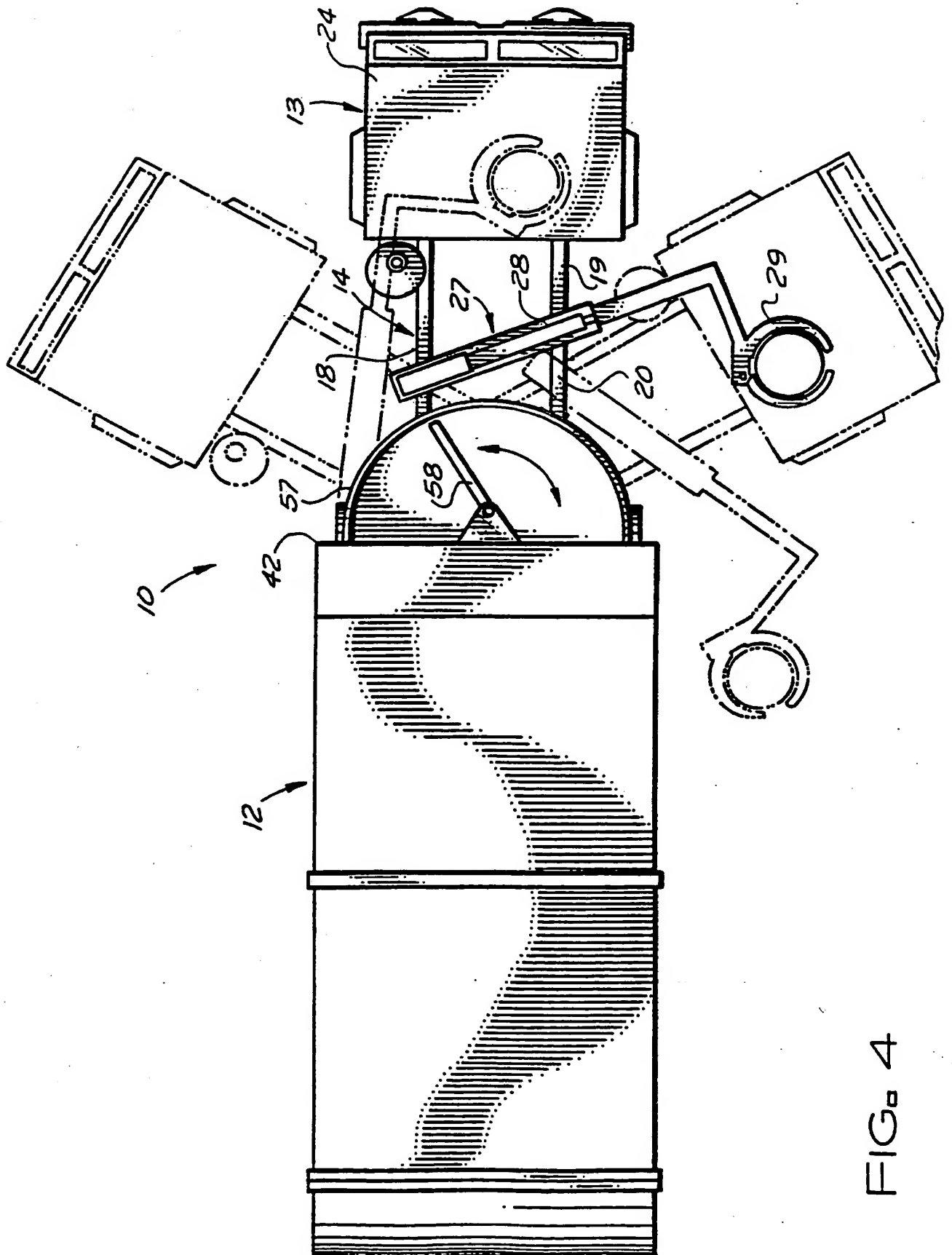


FIG. 4

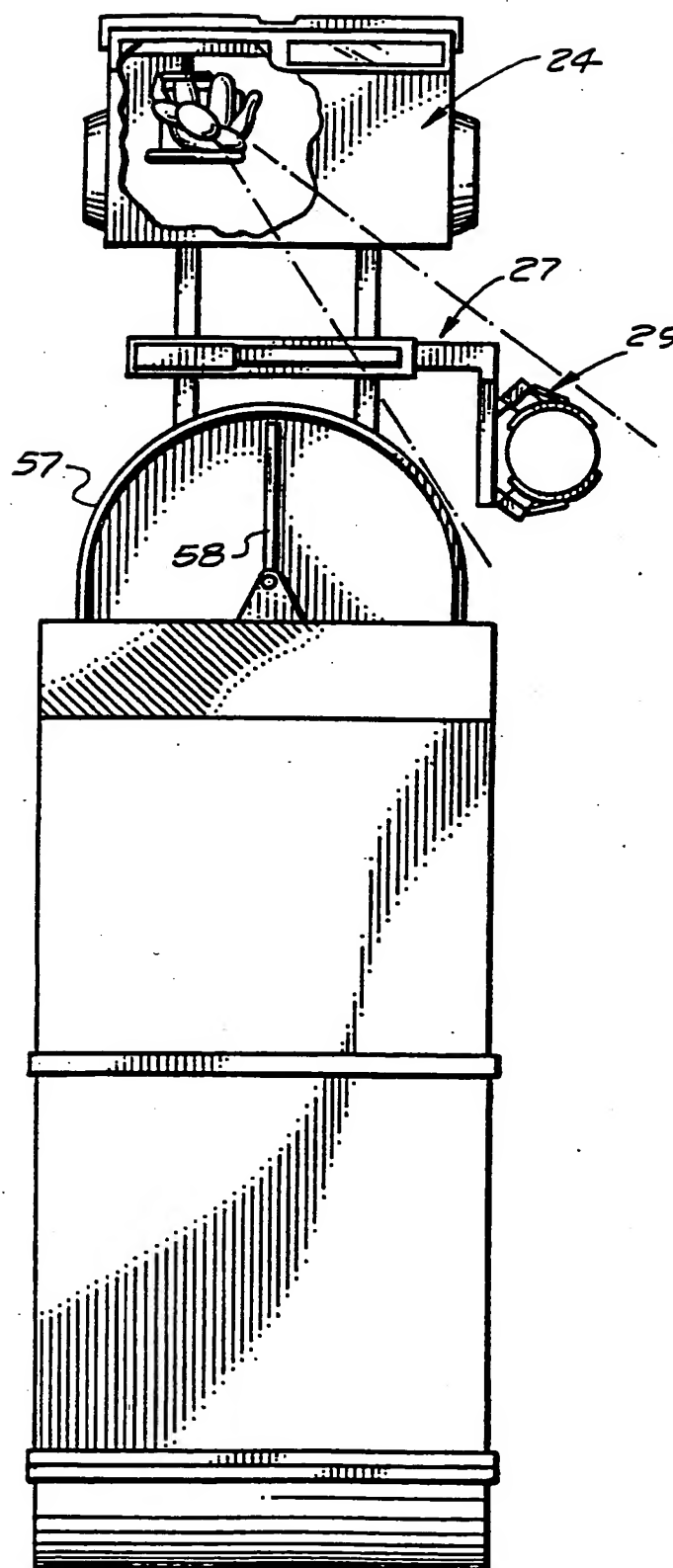


FIG. 5

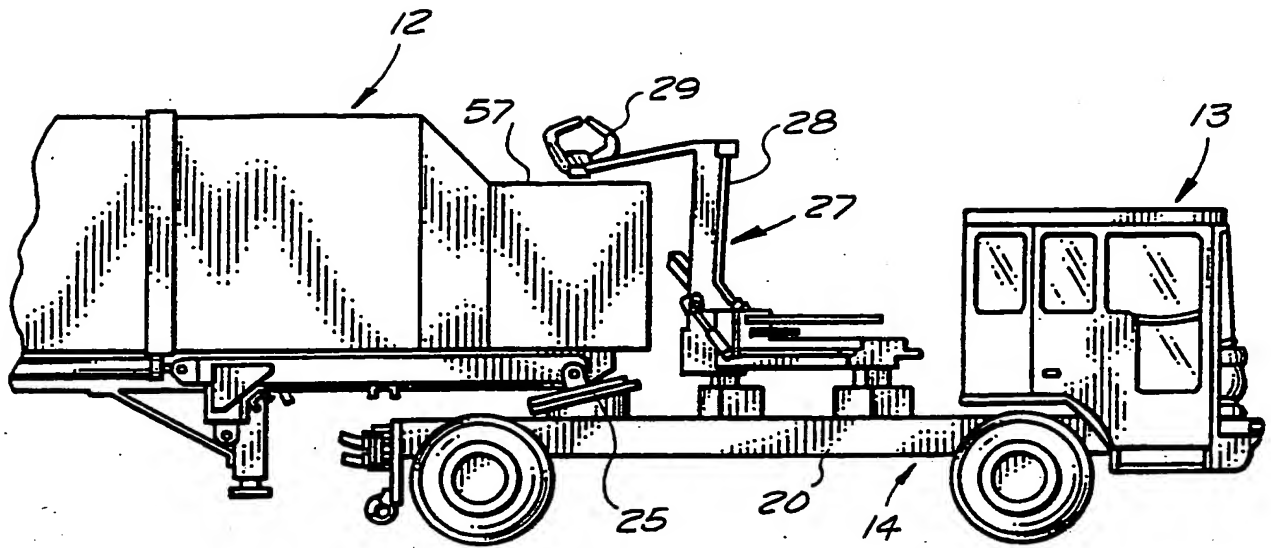


FIG. 6

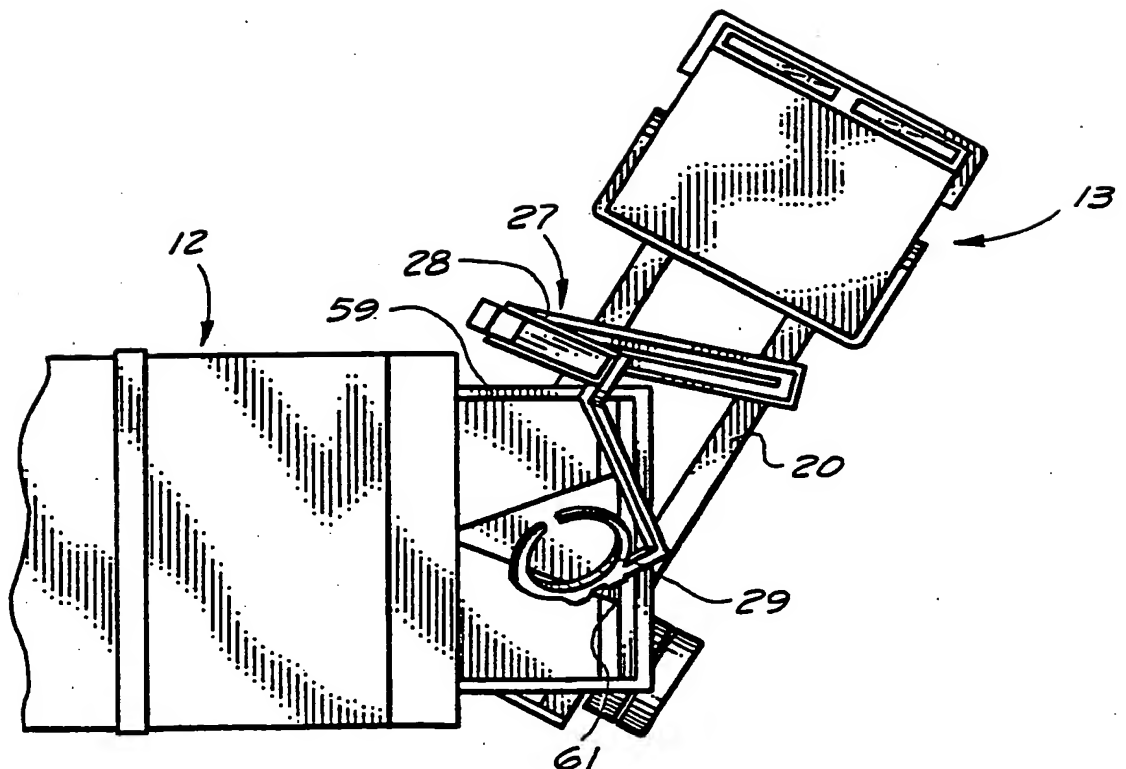
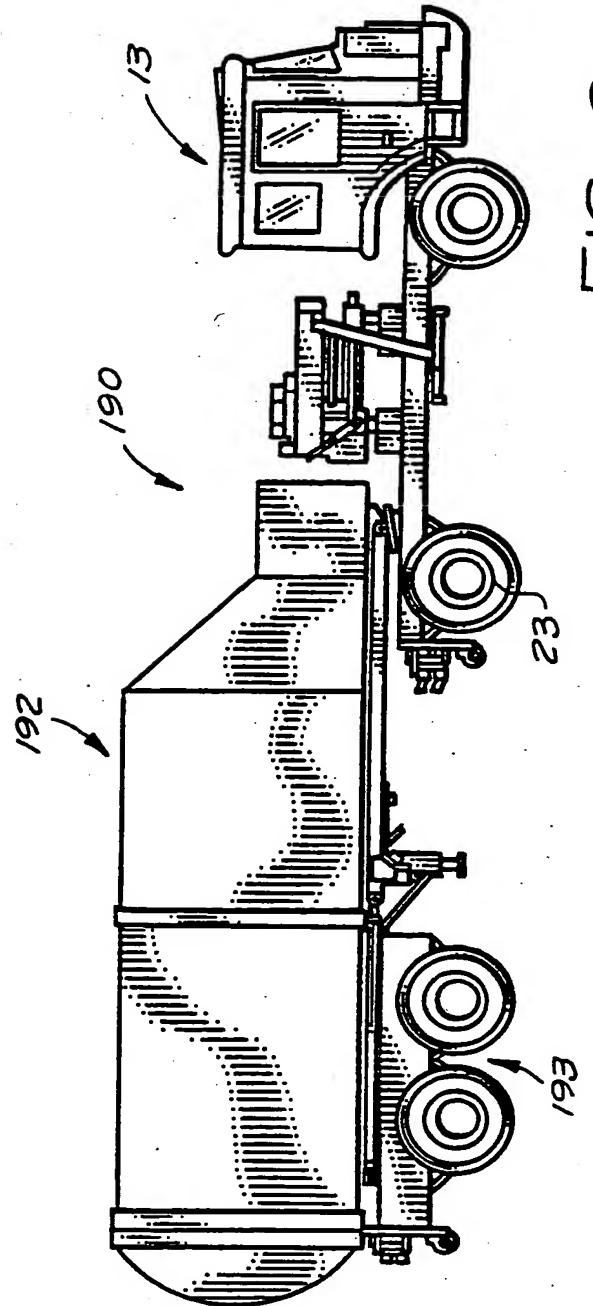
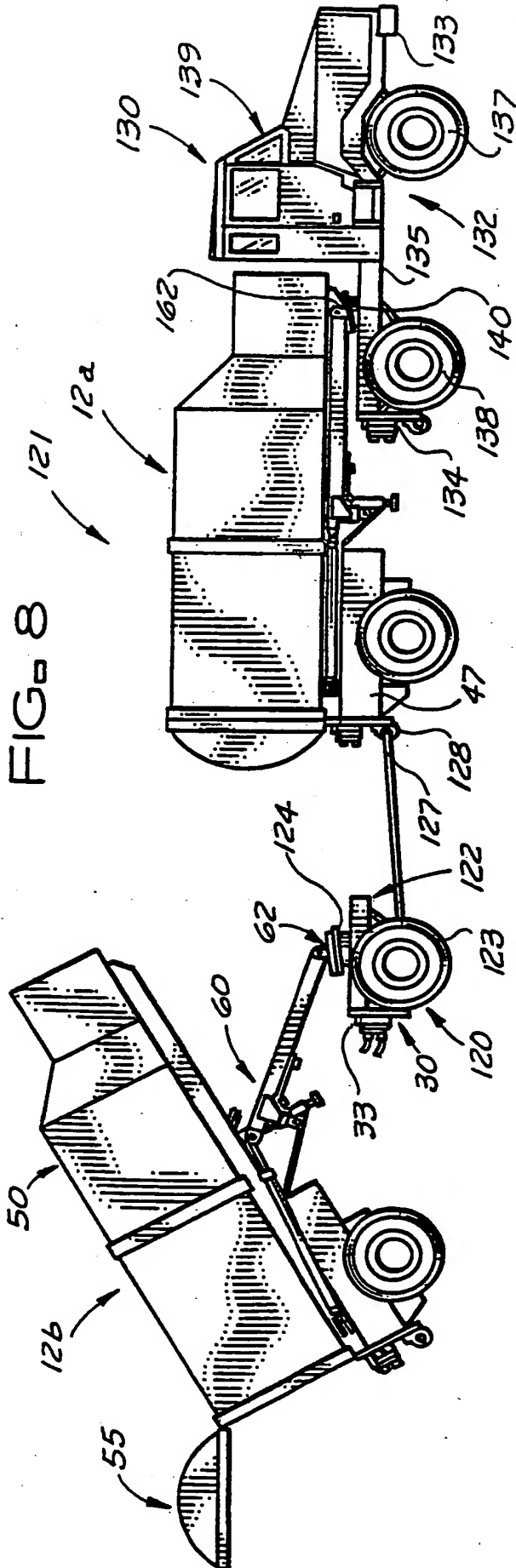


FIG. 7



7/9

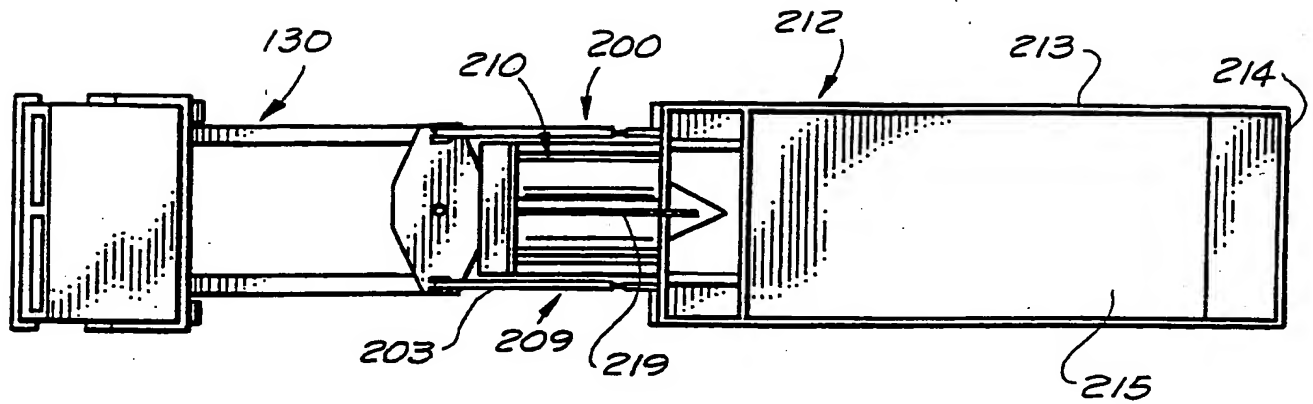


FIG. 10

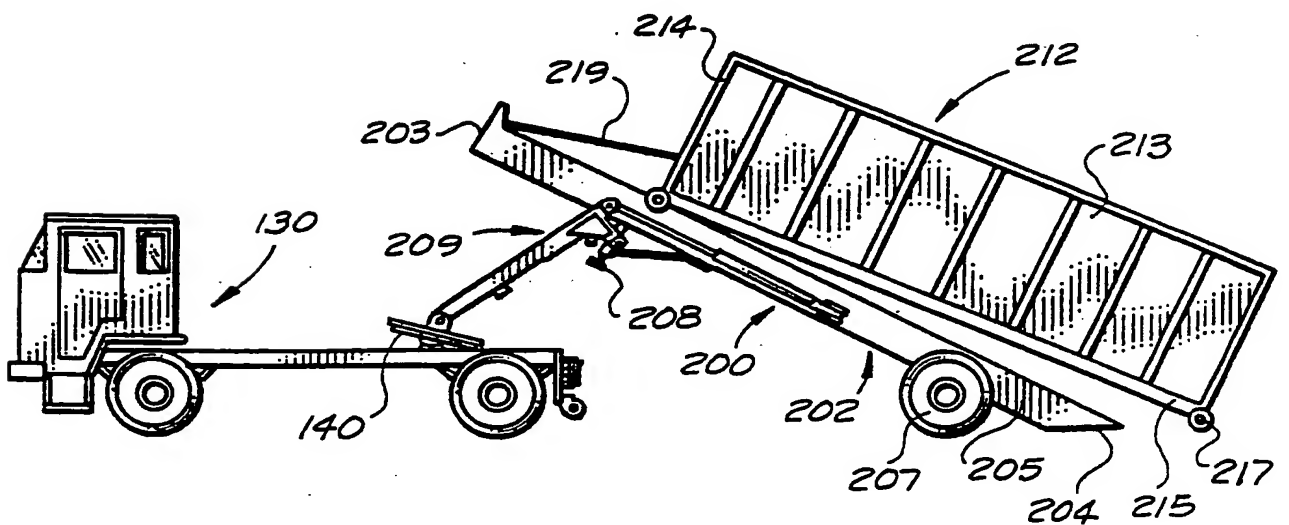


FIG. 11

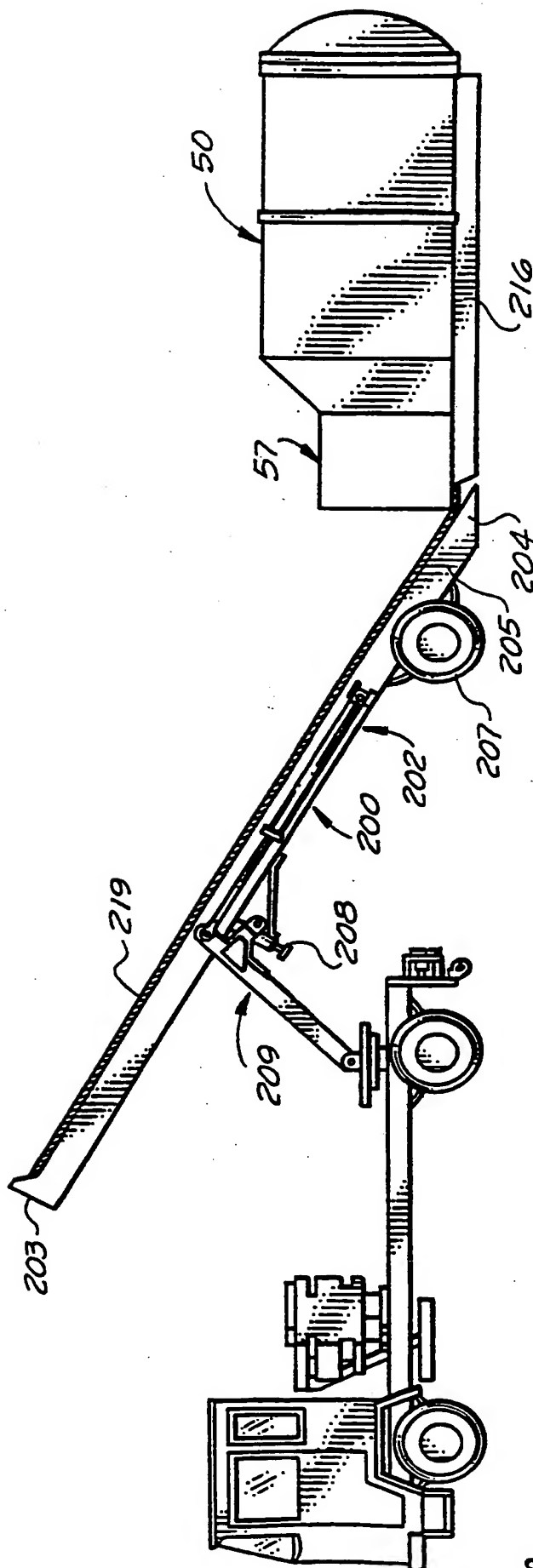


FIG. 12

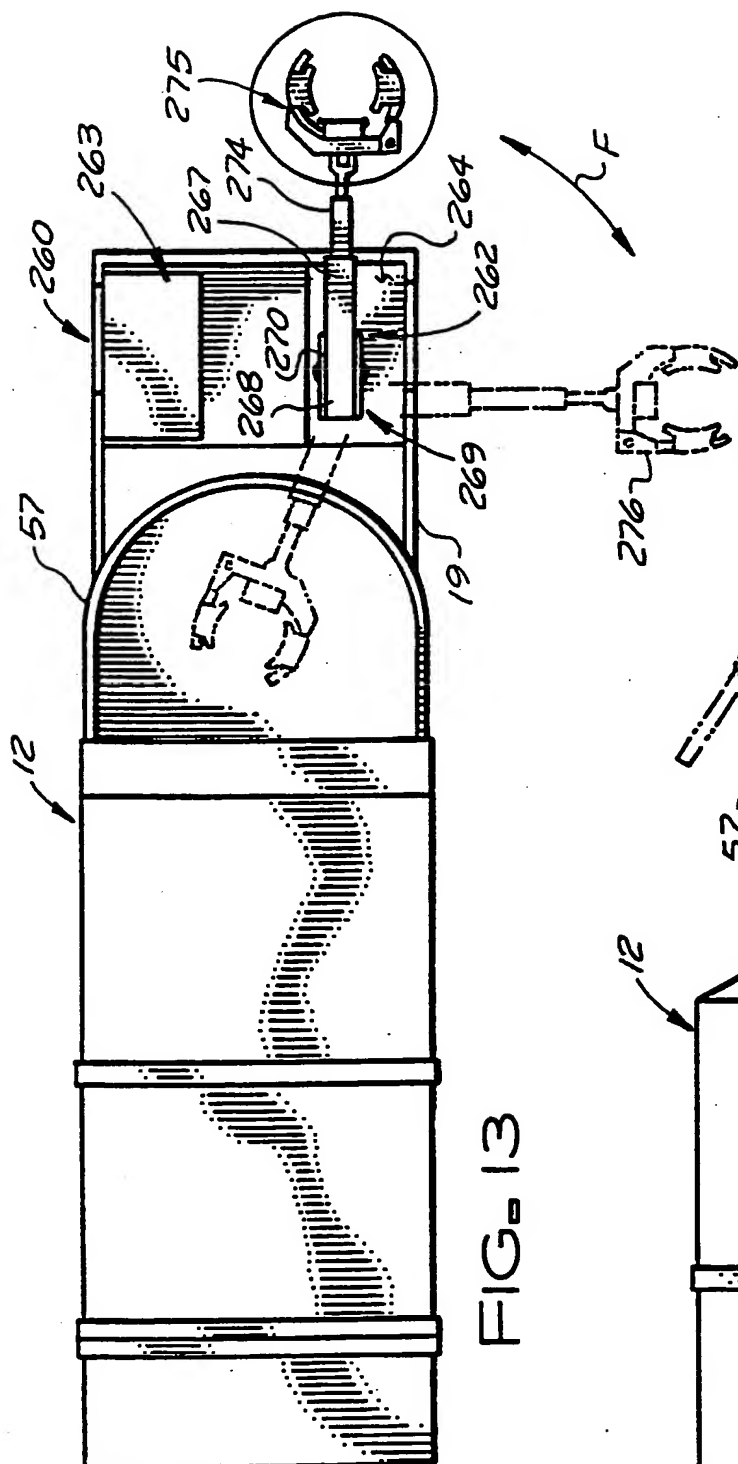


FIG. 13

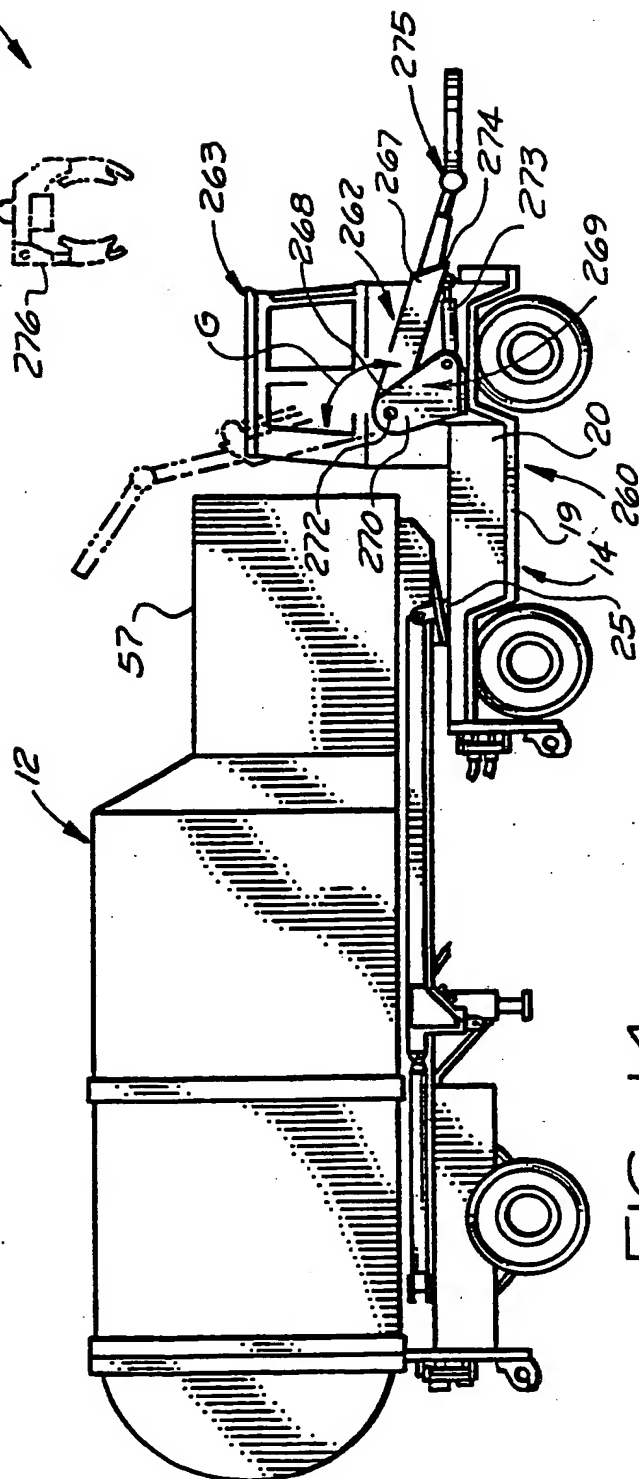


FIG. 14

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US94/02895**A. CLASSIFICATION OF SUBJECT MATTER**

IPC(5) :B65F 3/02,3/14,3/26

US CL :414/408,494; 280/476.1; 298/22AE

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : Please See Extra Sheet.

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|--------------|--|-----------------------|
| X -- Y | US,A, 2,824,658 (Beasley) 25 February 1958 See Figure 1 | 1,2 ----- 3-10 |
| Y | US,A, 4,096,959 (Schaffler) 27 June 1978 See Figures 1 and 8 | 3,5 |
| Y | US,A, 4,954,039 (Johnston et al) 04 September 1990 See Figures 2,7 and 8 | 4 |
| Y | US,A, 3,512,837 (Polich,Jr.) 19 May 1970 See Figures 3 and 7 | 6-9 |
| Y | US,A, 4,600,210 (McMurray) 15 July 1986 See Figure 1 | 10 |

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

| | | |
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| * "A" | Special categories of cited documents: document defining the general state of the art which is not considered to be of particular relevance | "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention |
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Date of the actual completion of the international search

08 JUNE 1994

Date of mailing of the international search report

JUN 24 1994

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US94/02895

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|-----------|--|-----------------------|
| A | US,A, 3,071,264 (Totaro et al) 01 January 1963 | none |
| A | US,A, 2,020,231 (Bell) 05 November 1935 | none |
| A | US,A, 3,880,072 (Ord) 29 April 1975 | none |
| A | US,A, 4,934,896 (Quinto) 19 June 1990 | none |
| A | US,A, 4,552,500 (Ghibaudo et al) 12 November 1985 | none |

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US94/02895

B. FIELDS SEARCHED

Minimum documentation searched

Classification System: U.S.

414/406,408,494,500,482,483,484,415

298/22AE,20A,19R

280/476.1,411.1,408,410

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